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15 April 1963

MEMORANDUM FOR: Assistant for Plans and Development

THROUGH : Executive Secretary, TDC

SUBJECT : Staff Study - Procurement of a High Quality Chip Comparator

1. PROBLEM:

How to provide the PI with a high quality stereomicroscope combined with a measuring capability for on-line use [redacted]

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2. FACTS:

The [redacted] Computer has been delivered and is now operational with the primary function of providing a real-time measuring capability for the PI. This function should apply throughout the entire range of PI activities i.e., from the immediate reporting stage through the most detailed reporting stages, including graphical analysis. After the immediate stages, where the film must be viewed by necessity in roll form, it is frequently desired to work with the film in cut or "chip" form. It is to this end which this study is directed.

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The objective is to provide the PI with a high quality chip comparator capable of operating on-line with the computer with a minimum of knowledge and training for the operator with respect to the actual measuring process. To this must be added the highest quality viewing optics available. The instrument must be of sufficient accuracy to handle all but the most specialized mensuration problems.

3. DISCUSSION OF THE FACTS:

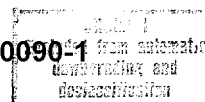
The various problems associated with measurement of cut film has been studied in detail and it is felt that accurate ground dimensions can be determined on chip formats with a minimum of PI training, if the chip comparator is one link of a system [redacted] Some of the other major components of the system are a film reader to assist in target selection, a high quality chip producing machine, and a remote location plotter output. Since the operation of these other instruments are out of the scope of this study they will not be discussed. However, the undersigned will be glad to discuss them in detail with anyone desiring to do so.

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A set of specifications was drawn up based on familiarization of both the chip measurement problems and the manufacturing state of the art and various manufacturers were contacted. It was felt that no known manufacturer had the optical, mechanical, and electronic capability in one facility to manufacture

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the high quality instrument required. Therefore, it was decided to negotiate for the various components separately and have the comparator manufacturer responsible for integrating them. This was felt to be necessary from the digital accumulator or readout aspect. In order to insure maximum compatibility, minimum operator training, and ease of maintenance, it is also felt that the readout for all the on-line equipment be identical; therefore, built by the same manufacturer. The optical head selected is manufactured [redacted] and will be a [redacted] configuration. The accumulator manufacturer will probably [redacted] however, all proposals are not in yet so a final decision is still pending. However, this item is of the shortest lead time. Staff studies will be presented shortly for procurement of these items.

The comparator manufacturer selected [redacted] The instrument they propose is in essence a prototype and the chip size in particular, as well as other characteristics, may be changed if necessary in any production models. The major characteristics of the instrument are:

a. Format size to be 70mm x 100mm with a usable measurement area of 70mm x 70mm. (This may be increased to 5" x 5" in subsequent models if required). The remaining 30mm x 70mm to be reserved for binary data block information.

b. Minimum measurement resolution of $\pm \frac{1}{4}$ micron. (The absolute accuracy will probably be better than the quoted ± 2 microns).

c. Measurement on prototype to be included on only one of the two stages, but space is provided in the design to allow for inclusion of third axis or ΔX measurements.

d. Measurement technique to be [redacted] interferometer.

e. Film hold down to be provided by a vacuum system. The close proximity of the viewing objectives preclude the use of pressure plates.

f. Illumination to be individually controlled variable intensity with variable filters for contrast control. The light sources so mounted to insure maximum heat dissipation.

g. The entire unit to be mounted in a specially constructed desk to insure maximum stability and minimize vibration. A small work space will be provided on the desk top for reference material (may possibly be a small light table).

h. Provision for inserting, at a later date, a data block reader.

In data reduction of information for any chip format it is necessary that the data be related to the geometry of the entire photograph (except a true vertical photograph of constant scales). When a chip is cut from a full format

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photograph the coordinate values of the chip with relation to the principal point must be retained in some manner. F&DS is now investigating equipment to directly apply this information in binary form to the chip as a data block. Also included will be the accession information such as mission, frame number, etc.

The ultimate purpose of the chip comparator is not to replace the conventional viewing equipment but to supplement it as back-up equipment when the maximum optical quality and accurate measurements are required. The design of the equipment will make it feasible to use oil emersion objectives if required.

Of considerable importance in selecting the [] comparator is its potential long life and freedom from accuracy loss due to wear. All mechanical components are designed so that adjustment can be made for any loss of accuracy due to wear. In addition the interferometer measuring system is not subject to wear as is the lead screw system. The proposed interferometer system offers one of the highest accuracies of any commercially available comparator systems on the market.

4. CONCLUSIONS:

The stereo chip comparator as proposed [] fills a definite NPIC need for a high quality chip comparator for on-line use by the PI in his intermediate and detailed reporting stages. The interferometer approach taken [] is a basically simple one and is a commercially available shelf item. Their proposal is to take their interferometer and package it into a well designed human engineered package for ease of operation. The proposed fixed price [] includes a stereo viewing, 2 measuring axis chip comparator system engineered into an integrated working table, but does not include the viewing optics or readout. It is estimated that a production run of the same instrument as proposed would be approximately half the prototype price.

5. RECOMMENDATIONS:

It is recommended that the proposal as presented [] be negotiated as soon as possible. [] be accepted and that a [] fixed price contract []